IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application of:	Benjamin Jay Diament	Confirmation No.:	5943
Serial No.:	10/690,401	Art Unit:	2162
Filed:	October 20, 2003	Examiner:	Truong, Cam Y. T.
For:	*Number-Range Search System and Method*	Attorney Docket No.:	060963-0015-US
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APPELLANT'S BRIEF UNDER 37 C.F.R. § 41.37

This Appeal Brief follows a Notice of Appeal filed April 28, 2008 and appeals the §101 rejection of claims 25-30 and 46-48, and the §103 rejection of claims 1, 3-6, 13, 15-18, 25, 27-30, and 37-48 by the United States Patent and Trademark Office in a fourth Office Action dated February 29, 2008.

In this Appeal Brief, Appellant demonstrates that claims 25-30 and 46-48 are directed to statutory subject matter, and thus the rejection under 35 U.S.C. § 101 cannot be sustained.

Appellant demonstrates that independent claims 1, 13, and 25 have at least one claim limitation not taught by the cited references Matsuda and Burrows, and thus the rejection of claims 1, 3-6, 13, 15-18, 25, 27-30, and 37-48 under 35 U.S.C. § 103 cannot be sustained.

A proposed amendment to claim 25 is included in Appendix XI.

The fee required under 37 C.F.R. § 1.17(c) is being filed concurrently herewith.

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I. The Real Party in Interest

The real party in interest in this appeal is Google Inc., the assignee of this application.

II. RELATED APPEALS AND INTERFERENCES

Appellant is not aware of any appeals, judicial proceedings, or interferences that will affect directly, will be affected directly by, or will otherwise have a bearing on, the decision in this appeal.

III. STATUS OF THE CLAIMS

The status of the claims is as follows:

- Claims canceled: 2, 7-12, 14, 19-24, 26, 31-36.
- Claims withdrawn from consideration but not cancelled: None.
- Claims pending: 1, 3-6, 13, 15-18, 25, 27-30, 37-48.
- Claims rejected: 1, 3-6, 13, 15-18, 25, 27-30, 37-48.
- Claims appealed: 1, 3-6, 13, 15-18, 25, 27-30, 37-48.

The claims on appeal, as currently pending, are listed in Section VIII, Claims Appendix. The Claims Appendix has a correct copy of the appealed claims.

Section XI, "Proposed Amendment to Claim 25" contains a proposed amendment to claim 25 to clarify that certain elements of the claim are stored in the memory element of the claimed search engine. This amendment has not been acted upon by the Examiner and thus have not been entered. See STATUS OF AMENDMENTS, below.

IV. STATUS OF AMENDMENTS

All amendments submitted prior to the filing of the Notice of Appeal have been entered. A copy of the appealed claims is attached as Section VIII, "Claims Appendix."

A proposed amendment to claim 25, submitted herewith, has not been entered. The proposed amendment to claim 25 is attached as Section XI, "Proposed Amendment to Claim 25".

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

This application has three pending independent claims, and each of these independent claims incorporates the subject matter described.

A. THE SUBJECT MATTER AS CLAIMED IN INDEPENDENT CLAIM 1

The claimed subject matter of claim 1 is a method of processing number-range search queries.[1]

Initially, a search query that includes a number range search query is received, wherein the number range includes a boundary number.[2] Note that boundary numbers are the bounds of a number range.[3] For example, if the search query includes the numerical range "10-100", the two boundary numbers for the search query are 10 and 100. In contrast, if the search query includes the numerical range ">10", the boundary number is 10.

An expression of numerical index terms based on the boundary number is generated.[4] A respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number.[5] For example, for the boundary number 727.1, the integral portion of a logarithm[6] of the boundary number is 2 in base 10. Note that the expression of numerical index terms can also include the digits of the boundary number, which are the quotients of the boundary number divided by successive powers of the base.[7] For example, for the boundary number 727.1, the digits are 7, 2, 7, 1 in base 10. Thus, the numerical index terms for the boundary number 727.1 can be represented as:

```
numrange_characteristic_2
numrange_digit_0_7
numrange_digit_1_2
numrange_digit_2_7
```

[1] Application specification ¶ [0006].
[2] Application specification ¶ [0050] and Figure 9.
[3] Application specification ¶ [0041].
[4] Application specification ¶ [0050] and Figure 9.
[5] Application specification ¶ [0028] and [0038]-[0048], and Figures 4-7.
[6] The logarithm, base 10, of boundary number 727.1 is approximately 2.86159, and the integral portion of the logarithm is 2.
[7] Application specification ¶ [0028].

numrange_digit_3_1_end

The term **numrange_characteristic_2** indicates that an integral portion of a logarithm of the boundary number is 2. The term numrange_digit_0_7 indicates that the first digit of the boundary number is 7. The term numrange_digit_1_2 indicates that the second digit of the boundary number is 2. The term numrange_digit_2_7 indicates that the third digit of the boundary number is 7. The term numrange_digit_3_1_end indicates that the last digit of the boundary number is 1. Note that the "integral portion of a logarithm of the boundary number" indicates where the decimal point for the boundary number should be placed. In this example, since the integral portion of the logarithm of the boundary number is 2, the decimal point is located after the third digit (e.g., between the 7 and the 1).

An exemplary expression of numerical index terms for a search query with a number range 721-727.1 can be represented as:

```
AND:
|----numrange_characteristic_2
|----numrange_digit_0_7
|----numrange_digit_1_2
|----OR:
     |---numrange_digit_2_1
     |---numrange_digit_2_1_end
     |---numrange_digit_2_2
     |---numrange_digit_2_2_end
     |---numrange_digit_2_3
     |---numrange_digit_2_3_end
     |---numrange_digit_2_4
     |---numrange_digit_2_4_end
     |---numrange_digit_2_5
     |---numrange_digit_2_5_end
     |---numrange_digit_2_6
     |---numrange_digit_2_6_end
     |---numrange_digit_2_7_end
     |---AND:
          |---numrange_digit_2_7
          |---OR:
               |---numrange_digit_3_0
               |---numrange_digit_3_1_end
```

Note that the "integral portion of a logarithm of the boundary number" is included in the exemplary expression (e.g., **`numrange_characteristic_2`**) shown above.

A document index is then searched using the expression to identify one or more documents containing numbers that satisfy the expression.[8] For example, the expression presented above can be used to identify documents which include numbers within the range 721-727.1. A result in accordance with at least a subset of the identified documents is then returned.[9]

B. THE SUBJECT MATTER OF INDEPENDENT CLAIMS 13 AND 25

Much of the subject matter taught in independent claim 1 also appears in the other independent claims. Because the subject matter of claim 1 is sufficient to establish patentability, Appellant believes that it is unnecessary to substantially repeat the above description.

Claim 13, directed to a computer readable storage medium for returning results of a number-range search query, has elements that have the same support in the specification as claim 1. A computer-readable medium having stored thereon instructions which, when executed by a processor performs the operations of claim 1 are disclosed in Figure 11, element 1110 and paragraphs [0067]-[0068] of the specification. Support for the first two operations listed in Claim 13 is provided by the element 400 (query encoder) in Figures 4 and 11 and by paragraphs [0038]-[0041] and [0068]; and support for the last two operations listed in Claim 13 is provided by element 1120 (index searcher) in Figure 11 and paragraphs [0027] and [0069].

Claim 25, directed to a search engine for querying number range searches, has elements that have the same support in the specification as claim 1. Support for the search engine (for querying number range searches) of claim 25 is provided by Figures 1, 4, and 11. Figure 11, described in paragraphs [0067]-[0069], shows a search engine (also called a query encoding system) comprising a server (1100) having one or more processors (1106) and memory (1110). The search engine of Figure 11 includes a query encoder (400) and index searcher (1120). Support for the query encoder and the expression generated by the query

[8] Application specification ¶ [0051] and Figure 9.
[9] Application specification ¶ [0027] and [0051], and Figures 1 and 9.

encoder is also provided by Figures 4 and 5, and paragraphs [0038]-[0042], while support for the index searcher is also provided by Figure 1 and paragraphs [0023]-[0027].

VI. GROUNDS OF REJECTION PRESENTED FOR REVIEW

Applicant contests, and requests review of each of the following grounds of rejection, all of which appear in the final Office Action mailed 02/29/2008.

A. THE § 101 REJECTION OF CLAIMS 25-30 AND 46-48.

The Examiner stated in the Office Action mailed 02/29/2008 on page 3 that:

> Claims 25-30 and 46-48 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter, specifically, as directed to an abstract idea.
>
> As regarding claims 25-30 and 46-48, "a search engine for querying number-range searches", The claims lack the necessary physical articles or objects to constitute a machine or a manufacture within the meaning of 35 U.S.C. 101. They are clearly not a series of steps or acts to be a process nor are they a combination of chemical compounds to be a composition of matter. As such, they fail to fall within a statutory category. They are, at best, functional descriptive material per se.
>
> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." Both types of "descriptive material" are nonstatutory when claimed as descriptive material per se, 33 F.3d at 1360, 31 USPQ2d at 1759. When functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare *In re Lowry*, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994).
>
> Merely claiming nonfunctional descriptive material, i.e., abstract ideas, stored on a computer-readable medium, in a computer, or on an electromagnetic carrier signal, does not make it statutory. See *Diehr*, 450 U.S. at 185-86, 209 USPQ at 8 (noting that the claims for an algorithm in Benson were unpatentable as abstract ideas because "[the sole practical application of the algorithm was in connection with the programming of a general purpose computer.").

Appellant will demonstrate that claims 25-30 and 46-48 are directed to statutory subject matter.

B. THE § 103 REJECTION OF CLAIMS 1, 3-4, 6, 13, 15, 16, 18, 25, 27-28, 30, 38, 40, 42, 44, 46, AND 48.

The Examiner stated in the Office Action mailed 02/29/2008 on page 5 that:

Claims 1, 3-4, 6, 13, 15, 16, 18, 25, 27-28, 30, 38, 40, 42, 44, 46, 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda ('Matsuda' hereinafter) (U.S. Publication Number 2003/0225779) in view of Burrows ('Burrows' hereinafter) (U.S. Publication Number 2004/0243569).

As to claims 1 and 13, Matsuda teaches the claimed limitations:

"receiving a number-range search query having a number range, wherein the number range includes a boundary number" as processing a query have a condition of price >10. 10 is represented as one boundary number (paragraph [0047]);

"generating an expression of numerical index terms based on the boundary number" as transforming query to an equivalence search using an inverted index generated, e.g., the exemplary query is simple query having a single search condition. For two numbers N and M, their tokens Ni and Mi, if N.M there exists, by definition, a token Nj which is greater than Mj. In this case, the transformed query has an index entry that includes attribute, token, list). The transformed query is based on number 10 (paragraph [0047, 0048, 0049], page 4, col. Right, lines 49-52),

"wherein at least one numerical index term includes information associated with an indexed number" as each index entry includes each token associated with an indexed number, e.g., token 0001 is associated with index 5 (page 4, col. Right, lines 49-52; fig. 5);

"searching a document index using the expression to identify one or more document containing indexed numbered that satisfy the expression" as returning to the search condition, document Ids are retrieved from each matching token index which results in an ID list of all documents that match those tokens (paragraph [0052]);

"returning a result in accordance with at least a subset of the identified documents" as (paragraph 0052, page 20, col. Right).

"wherein a respective numerical index term in the expression includes information indicative of an integral portion" as index term 01, 001, 0001 in table 1 includes a 1 bit in certain positions of the binary number indicates only numeric values that are greater than 10 (paragraphs 0051,0047,0048)

Matsuda does not explicitly teach the claimed limitation "of a logarithm of the boundary number".

Burrows teaches [0319] The number of levels needed to encode a range of N integers, with doubling of sizes, is a function of log.sub.2 N, where N is the number of possible range-based integer values to be encoded.

It would have been obvious to a person of an ordinary skill in the art at the time the invention was made to apply Burrows's teaching to Matsuda's system in order to process a query having multiple ranges more efficiently and further eliminate processing time by eliminating unnecessary physical accesses of the data while executing of the query and further order to identify

> locations of the records including portions of numeric information within the span of the range of value.

Furthermore, in response to the Applicant's arguments, the Examiner stated in the Office Action mailed 02/29/2008 on page 2:

> 2. Applicant's arguments filed 12/10/2007 have been fully considered but they are not persuasive.
>
> a. Applicant argued that the combination of Matsuda and Burrows does not teach "a logarithm of the boundary number". In response's to applicant's argument, examiner respectfully disagrees. Matsuda teaches a boundary number such as number 10 (paragraph 0047). Burrows teaches Burrows teaches [0319] The number of levels needed to encode a range of N integers, with doubling of sizes, is a function of log.sub.2 N, where N is the number of possible range-based integer values to be encoded.
>
> Thus, the combination of Matsuda and Burrows teaches the above claimed limitation.

For this appeal, Appellant focuses on the limitation "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number." Appellant will demonstrate that this limitation is taught by neither Matsuda nor Burrows nor the combined teachings of Matsuda and Burrows.

Appellant seeks to streamline the appeal process by focusing on this limitation, but does not thereby admit to the correctness or appropriateness of any other statement or issue raised by Examiner Truong.

C. THE § 103 REJECTION OF CLAIMS 5, 17, AND 29.

The Examiner cited a third reference against dependent claims 5, 17 and 29. Specifically, the Examiner, in the Office Action mailed 02/29/2008 at page 11, stated that:

> Claims 5, 17 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda in view of Burrows and further in view of Lewak et al. (or hereinafter "Lewak") (U.S. Patent Number 6,826,566).

For purposes of this Appeal, Applicant asserts that dependent claims 5, 17 and 29 are patentable over the combined teachings of the cited references (Matsuda, Burrows and Lewak) for the same reasons as their parent claims 1, 13 and 25. Lewak is cited by the Examiner only to address a specific limitation ("number type") in dependent claims 5, 7, and 29. The Examiner has not asserted that Lewak discloses or teaches anything related to the

claim limitation "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number." Therefore, for purposes of this Appeal, and without making any admission regarding the correctness or appropriateness of any other statement or issue raised by the Examiner, the patentability of claims 5, 17 and 29 over the cited references is based entirely on the patentability of their parent claims 1, 13 and 25.

D. THE § 103 REJECTION OF CLAIMS 37, 41, 45, 39, 43, AND 47.

The Examiner cited a fourth reference against dependent claims 37, 41, 45, 39, 43, and 47. Specifically, the Examiner, in the Office Action mailed 02/29/2008 at page 11, stated that:

> Claims 37, 41, 45, 39,43 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda in view of Burrows and further in view of Beavin et al. (or hereinafter "Beavin") (U.S. Patent Number 6,571,233).

For purposes of this Appeal, Applicant asserts that dependent claims 37, 41, 45, 39, 43, and 47 are patentable over the combined teachings of the cited references (Matsuda, Burrows and Beavin) for the same reasons as their parent independent claims 1, 13 and 25. Beavin was cited by the Examiner to address a specific limitation ("base 10") in dependent claims 37, 41, 45, 39, 43, and 47. The Examiner has not asserted that Beavin discloses or teaches anything related to the claim limitation "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number." Therefore, for purposes of this Appeal, and without making any admission regarding the correctness or appropriateness of any other statement or issue raised by the Examiner, the patentability of claims 37, 41, 45, 39, 43, and 47 over the cited references is based entirely on the patentability of their parent independent claims 1, 13 and 25.

E. THE § 103 REJECTION OF CLAIMS 37, 41, 45, 39, 43, AND 47.

The Examiner cited a fifth reference against dependent claims 37, 41, 45, 39, 43, and 47. Specifically, the Examiner, in the Office Action mailed 02/29/2008 at page 13, stated that:

> Claims 37, 41, 45, 39,43 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda in view of Burrows and further in view of Rajasekaran et al. (or hereinafter "Rajasekaran") (U.S. Patent Number 7,020,782).

For purposes of this Appeal, Applicant asserts that dependent claims 37, 41, 45, 39, 43, and 47 are patentable over the combined teachings of the cited references (Matsuda, Burrows and Rajasekaran) for the same reasons as their parent independent claims 1, 13 and 25. Rajasekaran was cited by the Examiner to address a specific limitation ("base 10") in dependent claims 37, 41, 45, 39, 43, and 47. The Examiner has not asserted that Rajasekaran discloses or teaches anything related to the claim limitation "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number." Therefore, for purposes of this Appeal, and without making any admission regarding the correctness or appropriateness of any other statement or issue raised by the Examiner, the patentability of claims 37, 41, 45, 39, 43, and 47 over the cited references is based entirely on the patentability of their parent independent claims 1, 13 and 25.

VII. ARGUMENT

Appellant argues that claims 25-30 and 46-48 are directed to statutory subject matter.

Appellant also argues that the limitation "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number" is not taught by any of the asserted references Matsuda, Burrows, Lewak, Beavin, Rajasekaran, or any combination thereof.

A. CLAIMS 25-30 AND 46-48 ARE NOT DIRECTED TO DESCRIPTIVE MATERIAL.

As a preliminary matter, claim 25 is directed to a search engine for querying number range searches, comprising one or more servers, each having one or more processors and memory. Thus, claim 25 and its dependents are directed to a machine (e.g., servers), which is a statutory class of invention. Furthermore, the search engine in claim 25 produces a useful, concrete, and tangible result: "an index searcher … to return a result in accordance with at least a subset of the identified documents." Thus, on these grounds, claim 25 is directed to statutory subject matter.

The Examiner avers that claims 25-30 and 46-48 are descriptive material per se (either nonfunctional descriptive material or functional descriptive material).[10] Claims 25-30 and 46-48 are clearly not directed to nonfunctional descriptive material for at least the reasons that claims 25-30 and 46-48: (1) are directed to a machine and (2) include functional units configured to perform specified operations (e.g., the query encoder and the index searcher).[11]

Claim 25 is not directed to descriptive material. MPEP 2106.01(I) states that there are two ways in which functional descriptive material can classified as nonstatutory subject matter: (1) when the claim is directed to a data structure not embodied in computer-readable media, and (2) when the claim is directed to a computer program listing. Claim 25 is not directed to data structures. Instead, claim 25 is clearly directed to one or more servers (each

[10] Page 4 of the Office Action mailed on 02/29/2008
[11] MPEP § 2101.01(II)

having one or more processors and memory) that include a query encoder and an index searcher, both of which are functional units that perform the claimed operations of the search engine. Since the claimed elements include memory (which is a computer-readable media), claim 25 is not directed "to a data structure not embodied in computer-readable media." Furthermore, claim 25 is not directed to a computer program listing. Again, claim 25 is directed to functional units in one or more servers which can perform the claimed operations of the search engine, and are not directed to computer program listings.

Therefore, claim 25 and its dependents are directed to statutory subject matter.

A proposed amendment to claim 25 is included in Appendix XI. In the proposed amended claim 25, the query encoder and index searcher are stored in the memory of one or more servers. The proposed revised version of claim 25 is directed to statutory subject matter for at least the same reasons as discussed above.

B. TO REJECT CLAIMS UNDER 35 U.S.C. § 103, ALL CLAIM LIMITATIONS MUST BE TAUGHT.

Case law requires that to "establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974) as cited at MPEP 2143.03.

C. DETERMINING "AN INTEGRAL PORTION OF A LOGARITHM OF THE BOUNDARY NUMBER".

"An integral portion of a logarithm of the boundary number" is determined by taking the logarithm of the boundary number, and then taking the integer portion of the logarithm.[12] For example, the logarithm (in base 10) of the number 727.1 is approximately 2.86159. Thus, the integral portion of the logarithm of the number 727.1 is 2. Note that the claim language specifically requires that "information indicative of [the] integral portion of a logarithm of the boundary number" be included in a numerical index term in an expression. This claim limitation requires three elements: (1) that there is at least one boundary number, (2) that the logarithm is of the boundary number, and (3) that information indicative of an integral portion of the logarithm is included in a numerical index term in an expression. (The

[12] Application specification ¶ [0028].

claims also require searching a document index using the aforementioned expression.) As demonstrated below, none of the references disclose these limitations.

D. THE CLAIMS REQUIRE THAT A NUMERICAL INDEX TERM INCLUDE INFORMATION INDICATIVE OF THE INTEGRAL PORTION OF THE LOGARITHM OF THE BOUNDARY NUMBER.

The claim language "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number" requires that information indicative of the integral portion of the logarithm of the boundary number be included in a numerical index term. It is noted that the pending claims require that this numerical index term be included in "an expression of numerical index terms based on the boundary number."

Including information indicative of the integral portion of a logarithm of the boundary number in a numerical index term allows a search engine to find (i.e., identify) documents that not only include integers (e.g., 11, 5001, etc.), but also include non-integers (e.g., 722.14, 721.267, etc.) that fall within a number range such as ">10" or "721-727.1".

E. MATSUDA DOES NOT DISCLOSE A NUMERICAL INDEX TERM THAT INCLUDES INFORMATION INDICATIVE OF THE INTEGRAL PORTION OF THE LOGARITHM OF A BOUNDARY NUMBER.

Matsuda discloses converting integers into the equivalent binary number and then generating tokens for the binary number.[13] For example, Matsuda discloses that the integer 10 can be represented as the 8-bit binary number 00001010.[14] Eight tokens are then created from the 8-bit binary number:[15]

Token 1 = 0
Token 2 = 00
Token 3 = 000
Token 4 = 0000
Token 5 = 00001
Token 6 = 000010
Token 7 = 0000101
Token 8 = 00001010

[13] Matsuda ¶ [0027].
[14] Matsuda ¶ [0027].
[15] Matsuda ¶ [0027]-[0041].

In this example, the integral part of the logarithm (base 10) of 10 is 1, but information indicative of this value is not indicated in the Matsuda tokens. (Token 5, 00001, represents the five most significant bits of the binary value 00001010, and does not represent the value "1".) Furthermore, the integral part of the logarithm (base 2) of 10 is 3, but information indicative of this value is also not indicated in the Matsuda tokens. (Token 7, 0000101, represents the seven most significant bits of the binary value 00001010, and does not represent the value "3".) Matsuda does not disclose or suggest that the integral part of the logarithm is included in tokens, which the Examiner equates to the numerical index terms in the pending claims.

F. BURROWS DOES NOT DISCLOSE A NUMERICAL INDEX TERM THAT INCLUDES INFORMATION INDICATIVE OF THE INTEGRAL PORTION OF THE LOGARITHM OF A BOUNDARY NUMBER.

Burrows discloses representing a range of integers by using successive levels of subintervals.[16] Each successive level (L1, L2, L3, etc.) of subintervals includes more integers than the previous level. For example, Burrows discloses an interval range 56 to 71 and four levels of subintervals that can be used to represent this range.[17] As illustrated in Burrows, each L1 subinterval represents one integer within the range, each L2 subinterval represents two integers (e.g., subinterval 56 in level L2 represents the integers 56 and 57), each L3 subinterval represents four integers (e.g., subinterval 56 in level L3 represents the integers 56, 57, 58, and 59), and each L4 subinterval represents eight integers (e.g., subinterval 56 in level L4 represents the eight integers 56, 57, 58, 59, 60, 61, 62, and 63).[18]

Burrows does not disclose a numerical index term that includes information indicative of the integral portion of the logarithm of a boundary number. For example, consider the number 56, which is at one boundary of the range 56 to 71. The number 56 has a logarithm, base 10, equal to about 1.74819. The integral portion of the logarithm of the number 56 is 1. (As it happens, the integral portion of the logarithm of the other boundary number, 71, is also equal to 1.) None of the L1, L2, L3, and L4 subintervals for the number range 56-71 (see Figure 19) can be considered to be information indicative of the integral portion of the logarithm of a boundary number. Each L1, L2, L3 or L4 subinterval simply represents a

[16] Burrows ¶ [0316]-[0319] and Figure 19.
[17] Burrows ¶ [0316] -[0319] and Figure 19.
[18] Burrows ¶ [0316] and Figure 19.

specific set of integers; no information about the logarithm of a boundary number is provided. Since, as taught by Burrows, an expression representing the range 56-71 contains only L1, L2, L3 and L4 subintervals, it is clear that Burrows does not disclose that a numerical index term includes information indicative of the integral portion of the logarithm of a boundary number.

The Examiner avers that paragraph [0319] discloses "a logarithm of the boundary number."[19] However, as the Examiner correctly states, Burrows paragraph [0319] discloses that "the number of levels needed to encode a range of N integers, with doubling sizes is a function of $\log_2$ N, where N is the number of possible range-based integer values to be encoded." It is clear that Burrows only discloses that the number of levels (of predefined subintervals) required to encode a range of N integers is a function of the logarithm of N. Thus, in the example above, the range 56-71 (N=16 integers) requires 4 levels ($\log_2 16 = 4$) of subintervals to encode the range. This logarithm is clearly not the same as taking the logarithm of the boundary number 56 (about 1.75) (or the logarithm of the boundary number 71, which is about 1.85) and generating an expression of numerical index terms based on the boundary number wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number (e.g., 1).

The following comparative example is helpful in understanding the difference between the (claimed) logarithm of a boundary number and the (Burrows) logarithm of the number of integers in a number range. The only logarithm value discussed in Burrows is the same for the range 345,656 to 345,671 as it is for the range 56 to 71. For both ranges, N=16 because there are 16 integers in both of these number ranges. The Burrows logarithm value for both of these number ranges is identical, $\log_2 16 = 4$, even though these two number ranges have boundary numbers (345,656 on the one hand, and 56 on the other) whose logarithm values are quite different (using base 2: $\log_2 56 \cong 5.807$ while $\log_2 345656 \cong 18.399$; or using base 10: $\log_{10} 56 \cong 1.748$ while $\log_{10} 345656 \cong 5.539$). This example clearly shows that the logarithm value in Burrows is not the logarithm of a boundary number of a number range. Therefore, paragraph [0319] of Burrows does not disclose "a logarithm of the boundary number" as the Examiner avers.

[19] Page 2 of the Office Action mailed on 02/29/2008.

In summary, at most, Matsuda discloses generating tokens for a number and Burrows discloses using one or more subintervals to represent a range of numbers. The only logarithm in Burrows is the logarithm of the number of integers in a specified range, which is independent from and unrelated to the logarithm of a boundary number. Neither Matsuda nor Burrows disclose including information indicative of an integral portion of a logarithm of a boundary number. Thus, the combination of Matsuda and Burrows cannot disclose "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number."

G. LEWAK DOES NOT DISCLOSE A NUMERICAL INDEX TERM THAT INCLUDES INFORMATION INDICATIVE OF THE INTEGRAL PORTION OF THE LOGARITHM OF A BOUNDARY NUMBER.

The Examiner avers that Lewak discloses value types that include numbers and dates, which is not the limitation addressed in this appeal.[20] Lewak does not discuss logarithms at all and therefore cannot disclose an integral portion of a logarithm.

H. BEAVIN DOES NOT DISCLOSE A NUMERICAL INDEX TERM THAT INCLUDES INFORMATION INDICATIVE OF THE INTEGRAL PORTION OF THE LOGARITHM OF A BOUNDARY NUMBER.

The Examiner avers that Beavin discloses that a numerical index term in the expression represents a respective digit of a respective number in base 10, which is not the limitation addressed in this appeal.[21] Although Beavin discusses logarithms, Beavin uses the logarithms to calculate an approximation error associated with converting a floating point number to a decimal number for a database query.[22] Beavin does not discuss a numerical index term that includes the integral portion of the logarithm of a boundary number.

I. RAJASEKARAN DOES NOT DISCLOSE A NUMERICAL INDEX TERM THAT INCLUDES INFORMATION INDICATIVE OF THE INTEGRAL PORTION OF THE LOGARITHM OF A BOUNDARY NUMBER.

The Examiner avers that Rajasekaran discloses representing each digit of a respective number in base 10, which is not the limitation addressed in this appeal.[23] Although Rajasekaran discusses logarithms, Rajasekaran uses the logarithms to calculate the order of

[20] Page 11 of the Office Action mailed on 02/29/2008.
[21] Page 11 of the Office Action mailed on 02/29/2008.
[22] Beavin columns 9-10.
[23] Page 14 of the Office Action mailed on 02/29/2008.

the execution time (e.g., logarithmic execution time). However, Rajasekaran does not discuss a numerical index term that includes the integral portion of the logarithm of a boundary number.

J. CONCLUSION

In summary, Appellant has demonstrated that: (1) the §101 rejections cannot be sustained because claims 25-30 and 46-48 are directed to statutory subject matter, and (2) the § 103 rejections cannot be sustained because the combination of references does not teach the claim limitation "wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number," which appears in all of the pending claims.

In view of the foregoing, Appellant respectfully requests the reversal of all the rejections in the Final Office Action of February 29, 2008. Appellant further requests allowance of all the pending claims 1, 3-6, 13, 15-18, 25, 27-30, and 37-48. If there are any other fees due in connection with the filing of this Brief, please charge the fees to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 60963-0015-US).

Respectfully submitted,

MORGAN, LEWIS & BOCKIUS LLP

Dated: May 27, 2008

By: / Gary S. Williams /
Gary S. Williams
Reg. No. 31,066

Customer No.: 24341
MORGAN, LEWIS & BOCKIUS LLP
3000 El Camino Real, Suite 700
Palo Alto, CA 94306
650-843-4000

VIII. CLAIMS APPENDIX

CLAIMS CURRENTLY ON APPEAL ORDERED BY NUMBER

1. A method of querying number-range searches, comprising:

receiving a number-range search query having a number range, wherein the number range includes a boundary number;

generating an expression of numerical index terms based on the boundary number, wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number;

searching a document index using the expression to identify one or more documents containing numbers that satisfy the expression; and

returning a result in accordance with at least a subset of the identified documents.

2. (Cancelled)

3. The method of claim 1, wherein at least one numerical index term in the expression includes information indicating that a specified digit is the last non-zero digit of a respective number.

4. The method of claim 1, wherein at least one numerical index term in the expression includes information indicative of the sign of a respective number.

5. The method of claim 1, wherein at least one numerical index term in the expression includes information indicative of a number type associated with a respective number range.

6. The method of claim 1, wherein the expression includes a plurality of numerical index terms that each correspond to a single respective digit of a respective number.

7-12. (Cancelled)

13. A computer-readable medium having stored thereon instructions which, when executed by a processor, cause the processor to perform the operations of:

receiving a number-range search query having a number range, wherein the number range includes a boundary number;

generating an expression of numerical index terms based on the boundary number, wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number;

searching a document index using the expression to identify one or more documents containing numbers that satisfy the expression; and

returning a result in accordance with at least a subset of the identified documents.

14. (Cancelled)

15. The computer-readable medium of claim 13, wherein at least one numerical index term in the expression includes information indicating that a specified digit is the last non-zero digit of a respective number.

16 The computer-readable medium of claim 13, wherein at least one numerical index term in the expression includes information indicative of the sign of a respective number.

17. The computer-readable medium of claim 13, wherein at least one numerical index term in the expression includes information indicative of a number type associated with a respective number range.

18. The computer-readable medium of claim 13, wherein the expression includes a plurality of numerical index terms that each correspond to a single respective digit of a respective number.

19-24. (Cancelled)

25. A search engine for querying number range searches, comprising:

one or more servers, each having one or more processors and memory, the one or more servers including:

a query encoder configured to receive a search query for a number range having a boundary number, wherein the query encoder is configured to generate an expression of numerical index terms based on the boundary number, and wherein a

respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number; and

an index searcher coupled to the query encoder and configured to search a document index using the expression to identify one or more documents containing numbers that satisfy the expression and to return a result in accordance with at least a subset of the identified documents.

26. (Cancelled)

27. The search engine of claim 25, wherein at least one numerical index term in the expression includes information indicating that a specified digit is a last non-zero digit of a respective number.

28. The search engine of claim 25, wherein at least one numerical index term in the expression includes information indicative of the sign of a respective number.

29. The search engine of claim 25, wherein at least one numerical index term in the expression includes information indicative of a number type associated with a respective number range.

30. The search engine of claim 25, wherein the expression includes a plurality of numerical index terms that each correspond to a single respective digit of a respective number.

31-36. (Cancelled)

37. The method of claim 6, wherein a respective numerical index term in the expression represents a respective digit of a respective number in base 10.

38. The method of claim 37, wherein the respective numerical index term in the expression corresponds to the position of the respective digit within the respective number.

39. The method of claim 1, wherein the integral portion of the logarithm of a respective boundary number is an integral portion of a base 10 logarithm of the respective boundary number.

40. The method of claim 1, wherein a respective numerical index term in the expression includes information indicative of a mantissa of a respective number.

41. The computer-readable medium of claim 18, wherein a respective numerical index term in the expression represents a respective digit of a respective number in base 10.

42. The computer-readable medium of claim 41, wherein the respective numerical index term in the expression corresponds to the position of the respective digit within the respective number.

43. The computer-readable medium of claim 13, wherein the integral portion of the logarithm of a respective boundary number is an integral portion of a base 10 logarithm of the respective boundary number.

44. The computer-readable medium of claim 13, wherein a respective numerical index term in the expression includes information indicative of a mantissa of a respective number.

45. The search engine of claim 30, wherein a respective numerical index term in the expression represents a respective digit of a respective number in base 10.

46. The search engine of claim 45, wherein the respective numerical index term in the expression corresponds to the position of the respective digit within the respective number.

47. The search engine of claim 25, wherein the integral portion of the logarithm of a respective boundary number is an integral portion of a base 10 logarithm of the respective boundary number.

48. The search engine of claim 25, wherein a respective numerical index term in the expression includes information indicative of a mantissa of a respective number.

IX. EVIDENCE APPENDIX

For this appeal, Appellants do not rely on any evidence submitted pursuant to §§ 1.130, 1.131, or 1.132, or other evidence entered by the Examiner.

X. RELATED PROCEEDINGS APPENDIX

Appellants are aware of no related proceedings.

XI. PROPOSED AMENDMENT TO CLAIM 25

The Appellant respectfully requests entry of the following proposed amendment.

Rewrite claim 25 as follows:

25. (Currently Amended) A search engine for querying number range searches, comprising:

one or more servers, each having one or more processors and memory, the memory of the one or more servers storing one or more programs to be executed by the one or more processors of the one or more servers, the one or more programs including:

a query encoder configured to receive a search query for a number range having a boundary number, wherein the query encoder is configured to generate an expression of numerical index terms based on the boundary number, and wherein a respective numerical index term in the expression includes information indicative of an integral portion of a logarithm of the boundary number; and

an index searcher coupled to the query encoder and configured to search a document index using the expression to identify one or more documents containing numbers that satisfy the expression and to return a result in accordance with at least a subset of the identified documents.